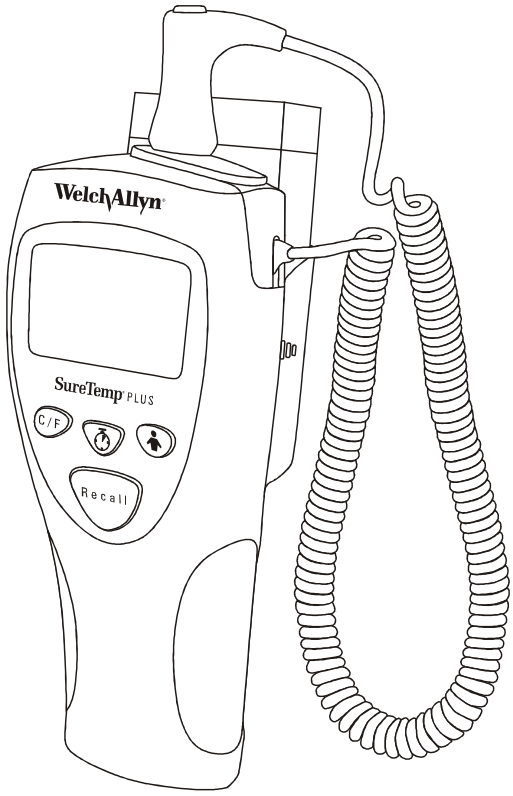
Welch Allyn®

Service Manual

SureTemp® Plus

Model 690 and 692 Thermometers



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The CE mark on this product indicates that the product has been tested to and conforms with the provisions noted within the 93/42/EEC Medical Device Directive.

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Electromagnetic Immunity and Emissions Declaration

Immunity Standard

IEC Basic Standard	IEC 60601-1-2 2001
Electrostatic discharge IEC 61000-4-2	± 6kV$_c$ ± 8kV$_c$
RF EMF Immunity IEC 61000-4-3	3/10 V/m 80 MHz-2.5GHz
Magnetic field IEC 61000-4-8	3A/m 150kHz-80MHz

Emissions Summary

The SureTemp® Plus model 690 and 692 thermometers are intended for use in the electromagnetic environment specified below. The customer or the user of the model 690 and 692 should assure that it is used in such an environment.

Guidance and Manufacturer's declaration - electromagnetic emissions

Emissions test	Compliance	Electromagnetic environment-guidance
RF emissions CISPR 11	Group 1 Class B	The SureTemp® Plus model 690 and 692 Thermometers are suitable for use in all establishments, including establishments that are connected to the public low-voltage power supply network.
Harmonic emissions IEC 61000-3-2	Complies	
Voltage fluctuations and flicker emissions IEC 61000-3-3	Complies	

1. General Information

1.1 About this Manual

This manual describes maintenance and troubleshooting procedures for the SureTemp® Plus Model 690 and 692 Thermometers. Most topics and procedures described in this manual are applicable to both products. Where there are differences, it is noted to which product the topic refers.

1.1.1 Related Document

End-user operation of the Model 690 and 692 Thermometers is covered in the SureTemp® Plus Model 690 and 692 Operator's Manual PN 71213-0000.

1.2 Technical Support and Service Centers

For information about any Welch Allyn product, call Welch Allyn Customer Support:

USA	+1 800 535 6663 + 1 315 685 4560	Australia	+61 2 9638 3000 +800 074 793
Canada	+1 800 561 8797	China	+86 21 6327 9631
European Call Center	+353 46 90 67790	France	+33 1 55 69 58 49
Germany	+49 7477 9271 70	Japan	+81 3 3219 0071
Latin America	+1 305 669 9003	Netherlands	+31 157 505 000
Singapore	+65 6419 8100	South Africa	+27 11 777 7555
United Kingdom	+44 207 365 6780	Sweden	+46 85 853 6551

1.3 Return Procedure

Please contact Welch Allyn® Customer Care at (800) 535-6663 *before* returning a Model 690 or 692 Thermometer to the factory for service.

If you are authorized to return a thermometer to Welch Allyn:

1. Contact Welch Allyn and request a Return Material Authorization Number (RMA).

2. Repackage the thermometer carefully in its original box or any sturdy carton with enough packing material to prevent damage. List the RMA # on the shipping label, along with the authorized service center address listed in Section 1.2, Technical Support and Service Centers.

3. Include a note that describes the problem, RMA number, return address, contact name, telephone number, and any other necessary information. Ship the thermometer to the authorized service center nearest you. See Section 1.2, Technical Support and Service Centers.

1.4 Safety and Warnings

- In order to obtain accurate and reliable temperature results and ensure patient safety, it is important that this manual is read thoroughly prior to using the instrument. If you have any technical or clinical questions concerning the thermometer’s use and/or care, please contact the Welch Allyn Customer Service Department.

- Use single-use Welch Allyn disposable probe covers to limit patient cross-contamination. The use of any other probe cover may produce temperature measurement errors or result in inaccurate readings.
- Do not take a patient's temperature without using a Welch Allyn disposable probe cover. Doing so can cause patient discomfort, patient cross contamination, and erroneous temperature readings.
- Long-term continuous monitoring beyond three to five minutes is not recommended in any mode.
- Biting the probe tip while taking a temperature may result in damage to the probe.
- Oral/axillary probes (blue ejection button at top of probe) and blue oral/axillary removable probe wells are used for taking oral and axillary temperatures only. Rectal probes (red ejection button) and red rectal removable probe wells are used for taking rectal temperatures only. Use of the probe at the wrong site will result in temperature errors. Use of the incorrect removable probe well could result in patient cross contamination.
- To ensure patient safety and temperature measurement accuracy, use only accessories and supplies recommended or supplied by Welch Allyn.
- Equipment is not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.
- The thermometer case, connectors, and probe are not waterproof. Do not immerse or drip fluids on these items. Should this occur, dry the device with warm air. Check all operating functions for proper operation.
- Do not take an axillary temperature through patient's clothing. Direct probe cover to skin contact is required.

- The Welch Allyn SureTemp Plus thermometer consists of high quality precision parts. Protect it from severe impact and shock. A qualified service technician must check any SureTemp Plus thermometer which is dropped or damaged to ensure proper operation prior to further use. Do not use the thermometer if you notice any signs of damage to the probe or instrument. Contact the Welch Allyn Customer Service Department for assistance.
- Welch Allyn recommends that batteries are removed for long term storage since alkaline batteries can deteriorate and leak over extended periods of time, and possibly cause damage to the thermometer.
- Do not autoclave. Please note the cleaning procedures described on page 14 of this manual.
- Do not use this instrument for any purpose other than that specified in this manual. Doing so will invalidate the instrument's warranty.
- This thermometer complies with current required standards for electromagnetic interference and should not present a problem to other equipment nor is it effected by other devices. As a precaution, avoid using this device in close proximity to other equipment.

1.5 Classifications

Type of protection against electric shock:	Internally powered equipment
Degree of protection against electric shock:	Type BF applied part
Degree of protection against ingress of liquids:	Not protected
Degree of safety in the presence of flammable anesthetics:	Equipment not suitable for use with flammable anesthetics
Mode of operation:	Continuous

2. Operating Characteristics

2.1 Basic System Description

The Welch Allyn® SureTemp® Plus Model 690 and 692 thermometers are portable electronic thermistor thermometers. Users can measure a patient's temperature in the oral, axillary, and rectal body sites of adult, pediatric, and newborn patients.

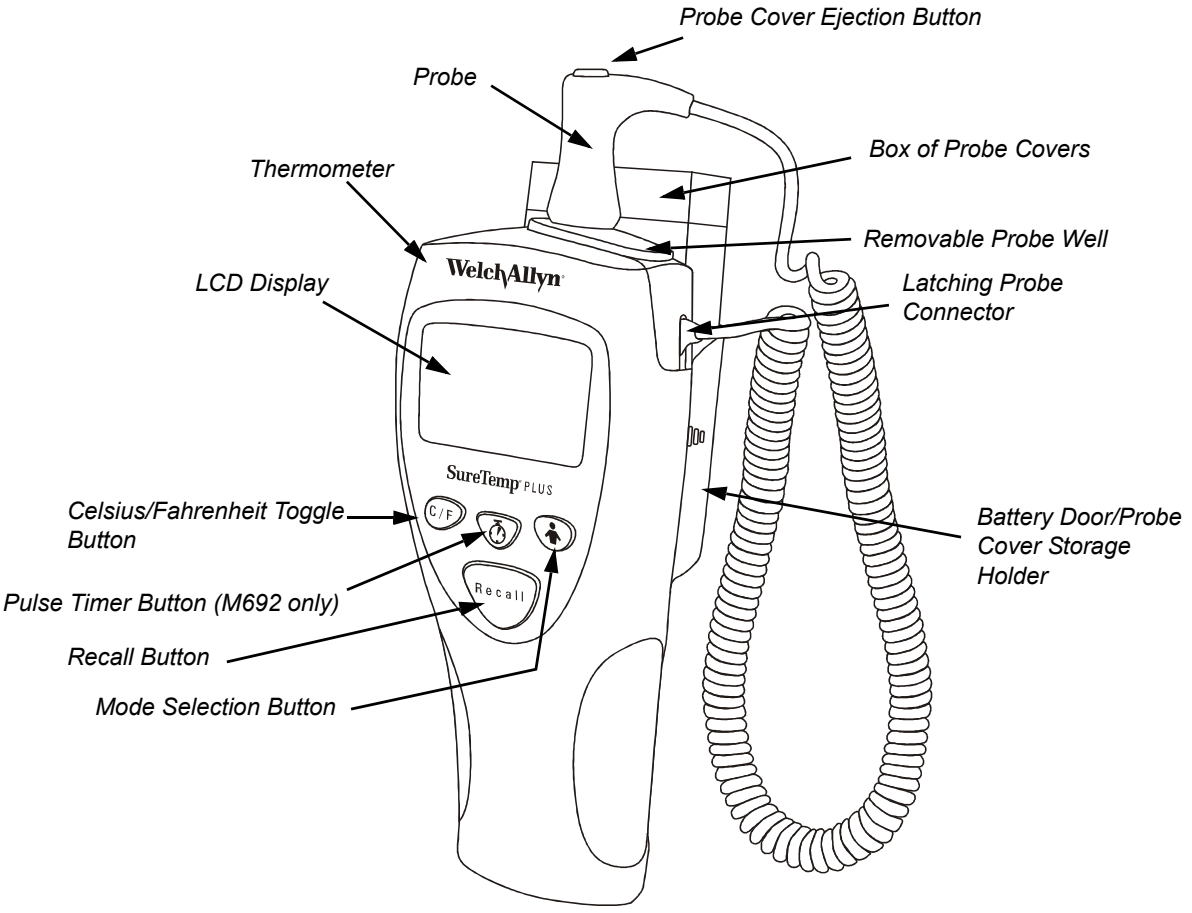


Figure 1: Model 692 Thermometer

The thermometer consists of six main components: the instrument, the probe, the removable probe well, the probe cover, the batteries, and the wall mount.

2.1.1 Instrument

The instrument includes a removable probe well and detachable probe.

2.1.2 Probe

The detachable probes are available in short (standard) or long cord versions and include a mechanical probe cover ejection mechanism, which is triggered by the user through a simple finger press. The probes are designed for easy exchange in the clinical environment.

- The short (standard) coiled cord probe stretches to approximately 4' and has a retracted length of approximately 10".
- The long version stretches to approximately 9’ and has a retracted length of approximately 28".

Four probe types are available and interchangeable on the thermometer:

1. A blue Oral/Axillary probe with a short (standard) coiled cord
2. A red Rectal probe with a short (standard) coiled cord
3. A blue Oral/Axillary probe with a long coiled cord
4. A red Rectal probe with a long coiled cord

2.1.3 Probe well

This unit has a removable probe well to allow for ease of cleaning and replacement. The blue probe well is used with Oral and Axillary probes, and the red probe well is used with Rectal probes.

2.1.4 Probe covers

The SureTemp® Plus Thermometers must use the standard Welch Allyn® thermistor probe covers, Part No. 05031. The probe covers are compatible across all Welch Allyn® thermistor-based thermometers.

2.1.5 Batteries

The Model 690 and 692 thermometers use three standard alkaline AA batteries, which provide longer life than standard AA batteries. No battery charging is available. The thermometer display will indicate when the batteries need replacement.

2.1.6 Wall Mount

The wall holder is easily secured to a wall. A locking mechanism with a removable key for securing the instrument is standard on the Model 692 Thermometer and is available as an option for the Model 690. Through the use of available long cord probes, the thermometer may be used without removing it from the wall holder.

2.2 Model Features

Features of the SureTemp® Plus Thermometer models (690 and 692) are listed below.

Table 2-1: Feature differences between Models 690 and 692

Feature	Model 690	Model 692
Probe Cover Storage	X	X
F/C Conversion	X	X
Last Temperature Recall	X	X
Monitor Mode	X	X
Detachable Probe	X	X
Oral/Axillary/Rectal Modes on Each Thermometer	X	X
Color-Coded Removable Probe Well	X	X
Wall-Holder	Optional	Standard
Pulse Timer		X
Backlight		X
Security (Electronic)		X
On-Screen Labeling for Instrument Identification		X

2.3 Operating Features

2.3.1 Instrument Reset

To perform a reset:

1. Remove the batteries from the instrument to reset the internal microprocessor electronics. Follow the battery removal instructions in the Preventive Maintenance section (page 14).

2. Remove the probe and the probe well from the instrument. Then, unplug the probe connector by depressing the locking tab and pulling on the connector body. DO NOT pull on the cord.

3. While watching the display, install the batteries per the instructions in the Preventive Maintenance section (page 14) and observe the Power-On Self Test described below.

2.3.2 Power-On Self Test (POST)

The self-test will check the internal microprocessor, instrument electronics, and display for correct operation.

The instrument performs the self-test series following all power-on or reset cycles. During the self test sequence the thermometer displays all LCD segments for 2 seconds. Concurrently, the thermometer plays the power-on audible notification and performs necessary self-testing.

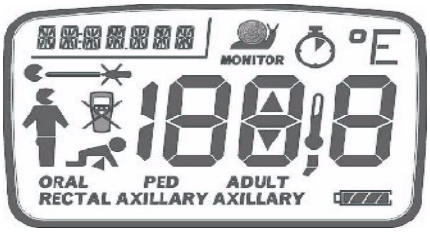


Figure 2: Model 690 and 692 Thermometer Displays

Immediately following the LCD segment test, the software revision is displayed on the screen for 2 seconds. At the end of the self-test, the display goes blank and the unit is ready to operate.

2.3.3 Low Power Mode

The Low Power mode allows the thermometer to conserve power when it is not in use.

The unit will automatically enter the Low Power mode following one of these conditions:

1. After a final predicted temperature has been taken, the probe has not been returned to the well, and the displayed temperature has been on the screen for 30 seconds.

2. When the instrument is in Monitor mode and the probe tip is out of the patient temperature range (80 °F to 110 °F) for a period greater than 5 minutes.

3. At the completion of the Recall mode time-out of 5 seconds.

4. Whenever the probe is returned to the well and the probe is plugged into the thermometer.

5. Whenever the probe is unplugged from the thermometer.

6. Whenever the unit is in the Biotech mode and there are no button presses for 5 minutes.

The unit will exit Low Power mode when any button on the instrument is pushed or the probe switch is activated. When the unit exits Low Power mode after the probe is removed from the well, all LCD segments are displayed for approximately 2 seconds.

2.3.4 Predict Mode

Predict mode operation is the rapid mode of temperature taking. This is the default mode and is automatically selected when the probe is withdrawn from the probe well. This mode provides the clinical user with predictive temperature capability for obtaining oral, rectal, pediatric axillary (17 years and younger), and adult axillary (18 years and older) temperatures.

If the mode is changed from Predict mode to Monitor mode during normal operation, it will change back to Predict mode when the probe is returned to the probe well.

1. Upon withdrawal of the probe from its storage well, every segment on the display is illuminated. The display will then show ORAL, ADULT AXILLARY, PED AXILLARY or RECTAL, depending on the probe and mode selected. It will also display °C or °F. In the upper left hand corner the ID will be displayed if one has been set (Model 692 only), and in the lower right hand corner the battery icon will be displayed. At the same time that the mode is displayed, a short beep will sound.
2. To change between the Oral, Adult Axillary, and Pediatric Axillary modes, press and release the Mode button. Observe that the display changes between ORAL, ADULT AXILLARY, and PED AXILLARY when the Mode button is pressed and released.
3. When the correct mode has been selected load a probe cover and take a temperature.

Note: It is possible that the walking segments will start and stop several times before the probe is inserted into the temperature site. This is acceptable and will not adversely affect the temperature taken.

2.3.5 Monitor Mode

The Monitor mode provides continuous temperature monitoring capability. The recommended wait time for a Monitor mode oral temperature and a Monitor mode rectal temperature is 3 minutes. The recommended wait time for a Monitor mode axillary temperature is 5 minutes.

The thermometer will automatically switch to Monitor mode under the following conditions:

1. If 60 seconds have passed since the thermometer was removed from the probe well.

2. If the instrument determines that room temperature is above 34.2°C (93.5°F).

3. If the thermometer is unable to predict an oral or axillary temperature after 20 seconds due to improper technique or excessive probe movement.

In the normal Predict mode, with correct use, the patient's oral temperature is displayed in approximately 4 seconds. The instrument will beep to signal completion of the Predict mode temperature cycle.

If the probe is left out of the storage well after completion of a Predict mode temperature, the unit will shut down after 30 seconds and enter Low Power mode to conserve power. Replace the probe in the storage well to prepare for the next temperature.

WARNING: Continuous monitoring for more than 3-5 minutes is not recommended in any mode.

Place the instrument in Monitor mode by pressing and releasing the Mode button after a predictive temperature is taken. This mode is indicated by an icon in the upper section of the screen.

When the unit enters Monitor mode, by pressing the Mode button after a predictive temperature is taken, it will emit two quick beeps. If the device enters Monitor mode for any of the three reasons listed earlier in this section, one long beep will sound to indicate that the unit has entered Monitor mode. The thermometer will not beep to indicate a final Monitor mode temperature and Monitor mode temperatures will not be stored in memory.

Monitor mode is also useful in testing the accuracy of the combined probe/instrument system when the probe is warmed to a known temperature, as with a Welch Allyn® Model 9600 or 9600 Plus Calibration Tester or in a circulating water bath.

Note: The instrument will shut off automatically if the probe temperature remains below 26.7°C (80.0°F) or above 43.3 °C (110.0 °F) for more than 5 minutes.

2.3.6 Pulse Timer Mode (Model 692 only)

Pulse Timer mode is activated from Low Power or Recall mode by pressing the Pulse Timer button. The display will then count up in seconds, and the unit will emit an audio beep at 0, 15, 30, 45 and 60 seconds. Pulse Timer mode terminates automatically after 60 seconds. The thermometer then returns to Low Power mode. The Pulse Timer can be stopped at any time during the 0-60 count by pressing the Pulse Timer button a second time. Pressing the Recall button, connecting a probe, or removing the probe from the probe well will also terminate the pulse timer.

2.3.7 Backlight (Model 692 only)

A backlight is provided by two high-efficiency amber LEDs, each supplied by a separate ballast resistor. The backlight is turned on automatically in any mode except Low Power mode and remains on. The backlight will automatically shut off when the unit goes into Low Power mode.

2.3.8 Horn

The horn is a miniature piezoelectric speaker which produces the audible tones that signal significant warning events to the user. The following audible signals will be played by the thermometer.

Table 2- 2: SureTemp® Plus Audible Signals

Signal	Description	Sound
POWER ON	Batteries are inserted in the device.	Charge up sound. Sound starts at a low frequency, increases in frequency, gets shorter in duration between each frequency.
POWER OFF	Battery level is too low and the unit is shutting down.	Charge down sound or losing power sound. Sound starts at a high frequency, decreases in frequency, gets longer durations between each frequency.
COMPLETE	Successful completion of a predict temperature or pulse timer.	Three quick beeps
OK	Start of Pulse Timer, Recall or Monitor mode	Two quick beeps
OK	Auto Monitor mode	One long beep
ERROR	Final temperature in error or Error mode	Two long beeps
CONFIRM	Any button press	One medium length beep
PULSE	Pulse Timer 15 second sound	One quick beep
SECURITY	Security State; i.e. device removed from security holder while security enabled and instant on = ON	Continuous series of beeps
READY	When probe is ready to insert into mouth (not when probe removed from well).	One medium length beep

2.3.9 F/C Conversion

The temperature switches to °F or °C scale by pressing and releasing the C/F button. The default temperature scale can be set to °F or °C in the biotech mode. A temperature must be displayed on the screen to switch between °F and °C.

2.3.10 Temperature Recall

This mode displays the most recently completed predicted temperature.

Whenever the instrument is in Low Power or Pulse Timer mode, pressing and releasing the Recall button on the front panel will cause the most recently predicted temperature to display for 5 seconds. The unit will then automatically go into Low Power mode.

Pulling the probe from the well in Recall mode will start a predict cycle. To enter Biotech mode, hold the Recall button down and then pull the probe from the well. Model 692 units must be in the wall holder to enter Biotech mode.

Pressing the Pulse Timer button on the Model 692 thermometer will interrupt the temperature recall function.

Note: No Monitor mode temperatures are saved for recall. When a temperature is recalled, the mode in which it was obtained (Oral, Adult Axillary, Pediatric Axillary, or Rectal) is displayed, regardless of the current mode the thermometer is in.

2.3.11 Biotech Mode

This mode is used to set and check special features of the thermometer listed in Table 2-1. All Biotech mode settings are saved so they are not lost when the batteries are replaced.

1. Place the thermometer in the wall holder (Model 692 Only).

2. Press and hold the Recall button, while removing the probe from the probe well. Once the probe is removed, release the Recall button.

3. Press and release the Recall button to move sequentially through the various program categories. Changes within each category are made by pressing and releasing either the Mode Selection or C/F button.

4. The Biotech mode control settings are stored in nonvolatile memory so that they are not lost when the batteries are changed. The Biotech mode will automatically time out after 5 minutes of inactivity.

5. Replacing the probe into the probe well at any time will exit the Biotech mode and return the unit to normal operation.

The following features and selections are available in the Biotech mode.

Table 2- 3: Biotech Mode Features

Function	Setting
DEVICE VERSION	The display will show “X.X”, where “X.X” is the device software version number (i.e. 1.0). This is helpful when discussing operation with Welch Allyn Customer Care.
ALGORITHM VERSION	The display should show “X.X” where “X.X” is the mode Software Version (i.e. 7.5). This is helpful when discussing operation with Welch Allyn Customer Care.
ID (Model 692 Only)	This section of the display is designed to store up to a seven digit alpha-numeric thermometer ID. To store the thermometer's ID, press and release either the Mode or the C/F button to change the value of the flashing digit. Press the Pulse Timer button to move to the next digit.
DEFAULT MODE	You may choose between four settings as the default predictive mode: Oral, Adult Axillary, Pediatric Axillary, and Last (last prediction). To change the default mode, press and release the C/F button or the Mode Selection button to advance to the next mode. This setting is retained in non-volatile memory when the batteries are replaced.
UNITS DEFAULT	This section displays the temperature measurement scale. To change the measurement scale from °F to °C, press and release the C/F button or Mode Selection button. This setting is retained in non-volatile memory when the batteries are replaced.
SITE INDICATION	Three options are available for mode indication: icon and words, words only, and icon only. To change the setting, press and release the Mode Selection button or C/F button to advance to the next type of indication. This setting is retained in non-volatile memory when the batteries are replaced.
SECURITY COUNT (Model 692 Only)	The anti-theft function uses a temperature counter that can be set at OFF, 25, 50, 100, or 200. • Press and release the Mode Selection button to select the desired security count. • Press and release the C/F button to select descending security count option (i.e. 200, 100, 50, 25, OFF). The instrument is set to the selected security count after the probe is returned to the probe well. This setting is retained in non-volatile memory when the batteries are replaced.
INSTANT ON (Model 692 Only)	The thermometer can be set to alarm when removed from the wall holder. This alarm can be disabled by the user by simultaneously pressing the Mode Selection button while pulling the probe from the probe well. When this security feature is set to ON and the thermometer is returned to the wall holder the security feature is reactivated. To set this security feature, press and release the Mode Selection button or C/F button to select ON (activated) or OFF (deactivated). This setting is retained in non-volatile memory when the batteries are replaced.
BATTERY	This setting displays the current battery voltage with 10 mV resolution. The battery is considered acceptable if it measures higher than 3.4 volts. A new battery should produce 4.5 volts or more.
COUNTER Predictive Temperature Counter	This setting displays the number of predictive temperature measurements that have been completed (in 100's).
ERROR LOG	This setting displays the last 10 saved error messages in a last-in, first-viewed sequence. This is helpful when discussing operation with Welch Allyn Customer Care. If there are no error messages, the display shows EMPTY LOG.
CLEAR LOG	This setting appears if the thermometer has logged any error messages. Press and release the Mode Selection button to select YES to clear the error log or NO to keep the entries in the log.

2.4 Instrument Security

Security options include two different electrical security options that alarms after a user designated number of temperatures is reached or when the unit is removed from the wall holder (Model 692 only). A mechanical security option is also available to prevent removal of the unit from the wall mount or mobile stand without a special tool. The design of the SureTemp® Plus Thermometers allows a facility to apply magnetic or RF security tags to the unit without adversely affecting the unit's performance or functionality.

The SureTemp® Plus Model 692 Thermometer has two distinct anti-theft systems available that are user selectable. Both systems require the use of a holder system with the thermometer. This setting will be retained in non-volatile memory when the batteries are replaced.

2.4.1 Temperature Count Security Feature

The Temperature Count security feature allows you to take a set number of temperature readings before the instrument goes into the security alarm state. The selectable counts are 25, 50, 100, and 200. As the instrument nears the final reading, it will display **SECURITY COUNT** as a warning, along with a number representing the last 5 temperature counts (i.e., 5,4,3,2,1) remaining on the security counter.

When the instrument enters the alarm state, it beeps for approximately 10 seconds. At this time, the instrument displays **SEC** on the LCD along with **SECURITY COUNT** in the ID field in the upper left-hand corner of the screen. The instrument is then disabled. Returning the instrument to the wall holder resets the security count. If the count is set to OFF, the temperature count function is disabled and no security alarm will occur.

This setting is programmable through the Biotech mode (page 11).

2.4.2 Instant-On Security Feature

When the Instant-On security feature is activated, the instrument goes into the security alarm state within five seconds after removal from the wall holder. When the instrument enters the alarm state, it beeps continuously and displays **SEC** on the LCD. Pressing the **Mode Selection** button while removing the probe from the probe well, within 30 seconds of the instruments removal from the wall holder, clears the alarm and allows the instrument to operate. Returning the instrument to the wall holder will reset the instant audio alarm.

The options for the Instant-On feature are ON and OFF. In the OFF setting, no security alarm will sound.

This setting is programmable through the Biotech mode (page 11).

3. Preventive Maintenance

The following preventive maintenance is **recommended** to maximize uninterrupted service with the SureTemp® Plus Model 690 and 692 Thermometers.

3.1 Six-Month Maintenance

Units that are in service on a regular basis should have the following preventive maintenance performed every six months:

1. Visually inspect the thermometer for any physical damage that might cause future product failure.

2. Clean the unit per instructions in the Operator's Manual supplied with the thermometer and/or per the instructions below.

3. Perform the Power-On Self Test and Model 9600 or 9600 Plus Calibration Testing procedure found in the *Model 9600 or 9600 Plus Operation Manual*.

3.2 Standard Storage

Units which are stored for an extended period should have the following maintenance performed every 12 months:

1. Remove the batteries before storage.

2. Reinstall the batteries and perform the Power-On Self Test and Model 9600 or 9600 Plus Calibration Testing procedure found in the *Model 9600 or 9600 Plus Operation Manual* before use.

3.3 Cleaning

3.3.1 Cleaning the Thermometer and Probe

- Wipe the thermometer regularly with a cloth dampened with warm water and a mild detergent solution.

- As needed, clean the thermometer and probe with a 70% isopropyl alcohol solution, a 10% chlorine bleach solution, or a non-staining disinfectant.

  WARNING: DO NOT immerse or soak the thermometer or probe in any type of fluid.

  WARNING: DO NOT use steam, heat or gas sterilization on the thermometer or probe. DO NOT autoclave the thermometer or the probe.

3.3.2 Cleaning The Removable Probe Well

- Remove the probe well from the unit. Unplug the latching probe connector to prevent the device from consuming battery power while you are cleaning the probe well.

- Clean the inner surface of the probe well by swabbing the surface with a cloth dampened with a mild detergent solution or a 70% isopropyl alcohol, a 10% chlorine bleach solution, or a non-staining disinfectant.
- Clean the probe well's outer surface by swabbing or wiping the surface with one of the solutions mentioned above.

- Immerse the probe well in mild detergent solution as necessary for cleaning.

  WARNING: DO NOT use hard or sharp objects to clean the probe well. This could damage the probe well and cause the unit to not function properly.

  WARNING: DO NOT use steam, heat or gas sterilization on the thermometer or probe. DO NOT autoclave the probe well.

- Thoroughly dry all surfaces before re-assembling the instrument.
- Re-connect the latching probe connector to the thermometer. Ensure that the connector snaps into place.
- Re-install the probe well in the thermometer and snap the probe well into place.
- Insert the probe into the well.

3.4 Replacing the Batteries

1. Remove the box of probe covers from the probe cover storage compartment on the back of the unit.

2. Remove the probe and the probe well.

3. Press inward on the textured grips on each side of the assembly to remove the battery door from the back of the unit.

4. Remove the three AA 1.5Vdc alkaline batteries and replace all three batteries with AA 1.5 Vdc alkaline batteries. Match the +/- polarity of each battery to the +/- symbols inside the battery compartment.

   WARNING: Use size AA 1.5 Vdc alkaline batteries only. Use of any other battery size or type could damage the thermometer and cause personal injury.

5. Snap the probe cover storage assembly back into place.

6. Replace the probe and probe well.

Note: Remove the batteries, if the instrument is not used for an extended period of time, to avoid possible damage to the thermometer due to battery leakage.

3.5 Calibration Testing

Whenever the clinical accuracy of the thermometer is in question, verify the instrument calibration. Your hospital biomedical department should establish a routine schedule for verifying instrument calibration. It is recommended the unit be tested semi-annually.

3.5.1 Cal-Key Verification

This method uses a fixed value to verify that the device is calibrated properly.

1. Remove any probe currently connected to the SureTemp® Plus Thermometer.
2. Connect the SureTemp® Plus Cal-Key (PN 06138-000).
3. Wait one minute for the device to enter Monitor mode and display the temperature.
4. The temperature should read 36.3 +/- 0.1ºC or 97.3 +/- 0.2ºF.
5. Remove the SureTemp® Plus Cal-Key.
6. Connect the original probe back to the device.

3.5.2 Model 9600 Calibration Tester Verification

This method is used to verify the calibration of the unit and probe pairing at two different temperatures. Use a verified thermometer from the Cal-Key Verification (3.5.1) and a functioning probe.

Caution: Store thermometers for testing in the same room as the 9600 Calibration Tester for approximately 30 minutes prior to testing to allow for thermal accomodation.

1. Plug in the Model 9600 Calibration Tester.
2. Choose the 96.4ºF/35.8ºC temperature setting. It is important to use the lower temperature setting first because the stabilization time from a high temperature to a low temperature takes about 20 minutes. Stabilization from lower temperature to higher temperature requires about four (4) minutes.
3. Wait for the Ready or green light to come on and stay on. This should take about six (6) minutes.
4. Remove the probe from the well and clean it with either a 70% isopropyl alcohol solution, a 10% chlorine bleach solution, or a non-staining disinfectant. Let the probe air dry. Do not apply a probe cover. Place the thermometer in Monitor Mode. Refer to the thermometer's Operator's Manual.
5. Lift the rubber flap on the 9600 and insert the probe fully into the small hole on top of the 9600.
6. Wait 2 minutes for the probe temperature to fully stabilize. The temperature should read between 96.1ºF/35.6ºC and 96.7ºF/36.0ºC.
7. Remove the probe from the small hole on top of the 9600 and replace it in the probe well.
8. Change the temperature setting to the 106ºF/41.1ºC setting.
9. Wait for the Ready or green light to come on and stay on. This should take about four (4) minutes.
10. Pull the probe from the well, but do not load a probe cover. Place the thermometer in Monitor Mode. Refer to the thermometer's Operator's Manual.

11. Lift the rubber flap on the Model 9600 Calibration Tester and insert the probe fully into the small hole on top of the tester.
12. Wait two (2) minutes for the probe temperature to fully stabilize.
13. The temperature should read between 105.7ºF/40.9ºC and 106.3ºF/41.3ºC.

3.5.3 Model 9600 Plus Calibration Tester Verification

This method is used to verify the calibration of the unit and probe at three set point temperatures 36.0ºC (96.8ºF), 38.5ºC (101.3ºF), 41.0ºC (105.8ºF). Use a verified thermometer from the Cal-Key Verification (3.5.1) and a functioning probe.

Caution: Store thermometers for testing in the same room as the 9600 Plus Calibration Tester for approximately 30 minutes prior to testing to allow for thermal accomodation.

1. Plug in the Model 9600 Plus Calibration Tester wall transformer to electrical power.

2. The 36.0ºC (96.8ºF) temperature setting is selected when the calibration tester is first powered on.

   If the calibration tester is all ready powered on, change the temperature setting on the Model 9600 Plus Calibration Tester to 36.0ºC (96.8ºF) with the up/down arrow key (temperature will scroll through the 3 settings).

   It is important to use the lower temperature setting first because the stabilization time from high temperature to low temperature takes about twenty (20) minutes. Stabilization time from a lower temperature to a higher temperature takes about six (6) minutes.

3. Wait for the displayed temperature to stop blinking. The actual temperature displayed blinks until the set temperature has stabilized.

4. Remove the probe from the thermometer well and clean it with either a 70% isoprophyl alcohol solution, a 10% chlorine bleach solution, or a non-staining disinfectant. Let the probe air dry for at least five minutes. Do not apply a probe cover. Place the thermometer in Monitor Mode. Refer to the thermometer's Operator's Manual.

5. Rotate the dust cover down so the Thermistor Device Port is open/available, leaving the Ear Device Port covered, and insert the probe fully into the small hole on top of the Model 9600 Plus Calibration Tester.

6. Wait for approximately one minute or until temperature on the thermometer is stable for ten seconds. Compare the thermometer's temperature reading to the 9600 Plus' calibration set point temperature. If the temperatures are within $\pm$ 0.1ºC ($\pm$ 0.2ºF), the thermometer is within calibration.

7. Remove the probe from the probe well and place back into the thermometer probe well.

8. Test all available thermometers for calibration verification at the current calibration set point temperature. Proceed to the next calibration set point temperature.

   To scroll from one set point to the next, press and hold the temperature selection button until a beep is heard. The newly selected set point appears in the upper left corner of the LCD display. The device's current temperature is displayed, will start to flash, and continue flashing until the cavity reaches the equilibrium at the new set point.

9. When done testing all thermometers at all temperature set points, close the dust cover on the Model 9600 Plus Calibration Tester.

4. Troubleshooting

Verify your Biotech Mode settings (page 11) to verify your device is configured properly.

If the device accuracy is in question, refer to the Calibration section on page 16.

If the above two tests do not help or cannot be done, read through the following to help diagnose the unit.

4.1 Types of Errors

Error indications fall into five major categories.

4.1.1 Battery Indications

Battery error occurs when the instrument detects the following:

Table 4- 1: Battery Indications

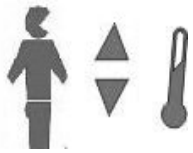
Display	Error	Indication
	Battery below operational range (< 3.00v)	Blinking battery frame, **b** on main display, arrow pointing down.
	Battery above operational range (> 5.375v)	Blinking battery frame, **b** on main display, arrow pointing up.
	Battery Low Warning (> 3.0v & <= 3.4v)	Single blinking battery segment in battery indicator.
	Battery levels	Gradual decline in number of segments showing in battery indicator.

4.1.2 Ambient Temperature Out of Range

Ambient Temperature errors occur when the ambient probe temperature is above 104.0° F or below 50.0° F. During an ambient temperature error, the display in the temperature number field shows a capital “A” followed by a blinking up or down arrow and a blinking thermometer bulb.

4.1.3 Patient Temperature Out of Range

Patient Temperature Out of Range errors occur when the patient temperature is above 110.0° F or below 80.0° F. During this error, the entire body (head, torso, and legs) displays by blinking with a solid up or down arrow and a thermometer bulb.

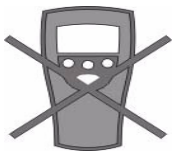


4.1.4 Probe Errors

The probe or probe connector can generate errors. Probe errors are displayed as a probe with an X through it and an error code in the temperature field. In most cases this will represent a broken probe that needs replacing and the code will tell what error was detected. Temperature measuring is prohibited until the error is cleared.

4.1.5 Instrument Errors

Instrument Circuitry errors are generated from internal test failures. Instrument errors are displayed as an instrument with an X through it and an error code in the temperature field. In most cases this will represent a broken instrument that needs replacing and the code will tell what error was detected. Error code numbers are available in Biotech mode under Error Log (see page 11).



4.1.6 Error Codes: Troubleshooting

The following table describes the error codes displayed on the thermometer, their corresponding descriptions, and the actions to take to correct the error. If the unit fails to operate properly after completing the suggested procedure listed in the following table, contact Welch Allyn® Customer Care at 1-800-535-6663.

Table 4- 2: Error Codes: Troubleshooting

Error Code	Description	Troubleshooting Steps
E0.1	Excessive Heater Energy	Try another predict cycle. If the problem persists replace the probe or contact Welch Allyn Customer Care.
E0.2	A/D Measurement out of range error.	Make sure the temperature is within the operating range of 50ºF/10ºC and 104ºF/40ºC If the problem persists replace the probe or contact Welch Allyn Customer Care.
E0.4	Probe Over Temperature (110ºF/43.3ºC)	Make sure the tip temperature is below 110ºF/43.3ºC. If the problem persists replace the probe or contact Welch Allyn Customer Care.
E0.5	No Probe Temperature Rise. (The heater has no effect.)	Try another predict cycle. If the problem persists replace the probe or contact Welch Allyn Customer Care.
E0.6	Probe EEPROM read failure. (Bad EEPROM handshake.)	Verify the batteries are fresh. If the problem persists replace the probe.
E0.7	Probe EEPROM is un-initialized.	Verify that the batteries are fresh. If the problem persists replace the probe.
E0.8	EEPROM CRC Failure (EEPROM is corrupted.)	Verify that the batteries are fresh. If the problem persists contact Welch Allyn Customer Care.
E0.9	Bad probe calibration.	Replace with a calibrated probe.
E4.0	PTB measurement out of range.	Try another predict cycle. If the problem persists contact Welch Allyn Customer Care.
E4.1	RCAL measurement out of range.	Try another predict cycle. If the problem persists contact Welch Allyn Customer Care.
E4.2	Reference power supply malfunction.	If the problem persists contact Welch Allyn Customer Care.
E4.3	Device EEPROM save failure.	Verify that the batteries are fresh. If the problem persists contact Welch Allyn Customer Care.
E4.4	Device EEPROM starting handshake failure.	Verify that the batteries are fresh. If the problem persists contact Welch Allyn Customer Care.
E4.5	Device EEPROM response failure.	Verify that the batteries are fresh. If the problem persists contact Welch Allyn Customer Care.
E4.6	Transmit failure to the Device EEPROM.	Verify that the batteries are fresh. If the problem persists contact Welch Allyn Customer Care.
E4.7	Can’t initialize the device EEPROM	If the problem persists contact Welch Allyn Customer Care.
E4.8	Device was not calibrated	Replace the device with a calibrated device.
E5.0	Heater is not working properly.	Try another cycle. If the problem persists contact Welch Allyn Customer Care.

Table 4- 2: Error Codes: Troubleshooting

Error Code	Description	Troubleshooting Steps
E5.2	Heater fail-safe failure.	Contact Welch Allyn Customer Care.
23	Host Interface Error	Try another predict cycle. If the problem persists contact Welch Allyn Customer Care.
26	Invalid SureTemp mode	Try another predict cycle. If the problem persists contact Welch Allyn Customer Care.
29	Battery Voltage Is Not Set	Try another predict cycle. If the problem persists contact Welch Allyn Customer Care.
30	Prediction mode Is Not Set	Try another predict cycle. If the problem persists contact Welch Allyn Customer Care..
71	Device EEPROM acquire failure	Try another predict cycle. If the problem persists contact Welch Allyn Customer Care.
72	Device EEPROM release failure	Try another predict cycle. If the problem persists contact Welch Allyn Customer Care.
73	DEVICES EEPROM invalid pointer failure.	Try another predict cycle. If the problem persists contact Welch Allyn Customer Care.
b^	Battery voltage too high.	Replace the batteries with batteries that provide less then 5.50 volts to the SureTemp® Plus.
bv	Battery voltage too low.	Replace the batteries with new batteries. If problem does not go away and the batteries are known as good (>= 3.1 volts applied) contact Welch Allyn Customer Care.
A^!	Ambient temperature too high.	Move into an area where the temperature is between 50ºF/ 10ºC and 110ºF/43.3ºC and allow the thermometer to stabilize to ambient temperature. If problem persists replace the probe or contact Welch Allyn Customer Care.
Av!	Ambient temperature too low.	Move into an area where the temperature is between 50ºF/ 10ºC and 110ºF/43.3ºC. If the problem persists replace the probe or contact Welch Allyn Customer Care.
	Patient Temperature out of range. < 80ºF/26.7ºC or > 110ºF/43.3ºC	Make sure the probe is positioned properly within the patient body site, with good tissue contact, and/or verify the patient's temperature is in the range. Try another temperature cycle with the probe positioned properly. If the problem persists, replace the probe or contact Welch Allyn Customer Care.

Note: If your thermometer is within the warranty period, you should return the unit to an authorized service representative for servicing. Failure to do so will invalidate the warranty.

4.2 Field Serviceable Repairs

The only operations that are performed by field personnel are calibration verification, probe or probe well replacement, battery replacement, and unit replacement.

4.3 Field Serviceable Parts

The following parts are serviceable by qualified technicians.

Note: The following parts list is current as of the date of publication. Parts and part numbers may change without notice. Check with Welch-Allyn® Customer Care prior to ordering parts to verify you have current part number information.

Table 4- 3: Field Serviceable Parts

Part #	Description
01802-110	9600 Plus Calibration Tester
02891-000	Removable Probe Well (Blue)
02891-100	Removable Probe Well (Red)
02892-000	Probe and Well Kit (Incl. Probe) 4 ' Rectal
02892-003	Probe and Well Kit, 4', Vet
02892-100	Probe and Well Kit (Incl. Probe) 9 ' Rectal
02892-103	Probe and Well Kit, 9', Vet
02893-000	Probe and Well Kit (Incl. Probe) 4 ' Oral
02893-100	Probe and Well Kit (Incl. Probe) 9 ' Oral
05031-101	Disposable Probe Covers - 1000/Case
25261-0000	Housing, Front, M690-692
25262-0000	Housing, Rear, M690-692
25263-0000	Housing, Battery Door, M690/692
25278-0000	Cover, Serial Port
53009-000	Batteries AA Alkaline
71209-0000	Label, Front, M690/Green
71209-1000	Label, Front, M692/Blue
71210-0000	Label, Icon ID, M690/692, English
71221-0000	Technical, Manual, M690/692
71213-0000	Operators Manual (DFU)
83216-0000	Scr, Plastite, Phil,#2-28X.313L

5. Theory of Operation

5.1 Technical Overview

The SureTemp® Plus Model 690 and 692 are portable, battery powered thermistor-based medical grade thermometers that perform oral, axillary, and rectal measurements using high-speed prediction modes.

The devices perform a power-on self test (POST) when battery power is applied. POST checks the internal hardware, and tests the stored calibration values to verify that the factory calibration is intact. When a thermometer probe is connected, the device reads data from the probe to determine the type of probe and probe calibration values. The thermometer will go into Low Power mode when inactive to maximize battery life.

A predict measurement cycle is initiated when a connected thermometer probe is pulled from the probe well of the device. When the probe is pulled from the probe well the optical probe detection switch wakes up the microprocessor and a measurement cycle begins. The device pre-heats the probe tip (Oral and Axillary only) to create a stable thermal environment at the probe tip. When the tip is applied to the patient the tip heater is turned off. The thermistor value is monitored by the microprocessor and other internal circuitry. The microprocessor uses internal modes to process the thermistor data and calculate a patient's temperature. The temperature data is then displayed to the user on the LCD. It is also possible to switch the thermometer to Monitor mode, which displays real-time data from the thermistor.

The Model 692 thermometer includes a backlit LCD for viewing in low ambient light conditions and a security mode that disables device operation when used outside the programmed security parameters.

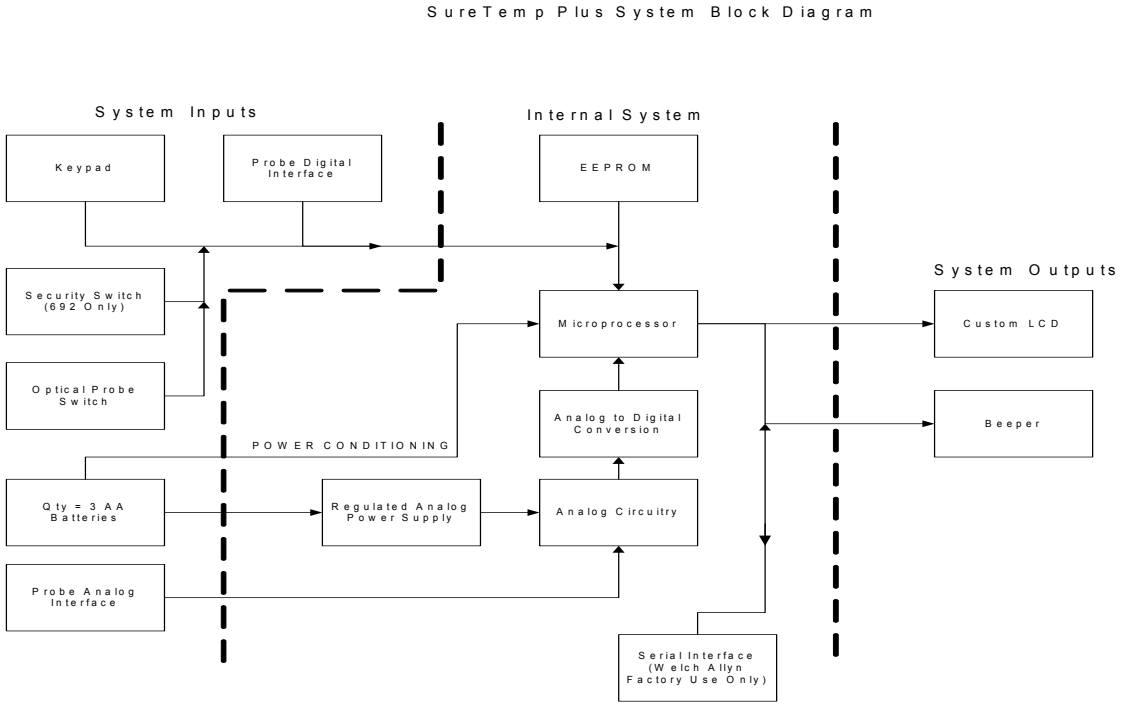


Figure 3: Model 690 and 692 Thermometers System Block Diagram

5.1.1 Temperature Probes

Model 690 and 692 Thermometer probes are configured at the factory to be Oral/Axillary or Rectal probe types.

The probe contains a thermistor, a heater resistor, and an EEPROM.

Table 5- 1: Probe Parts

Probe Part	Description
Thermistor	The Thermistor is used to sense patient temperature.
Heat Resistor	The heater is used to create a stable thermal environment at the tip of the probe prior to applying the tip to the patient.
EEPROM	During calibration, the I^2C SDA line is accessed via the probe connector and SCL by a special probe connection that does not connect to the thermometer. The thermometer reads the EEPROM via its 2-wire serial-only (VESA DDC1) interface. The interface is guaranteed to work with VCC of 2.7 to 5.25 volts.

5.1.2 Probe Switch

The probe switch is an optical LED switch. It is arranged as an open circuit when the probe is in the well, to save power. This causes a High-to-Low transition when the probe is pulled.

5.1.3 Power Supply

Power for the Model 690 and 692 is drawn from the three AA alkaline cells directly to the circuit electronics, providing a peak voltage of 4.8V and an average voltage of 3.60 V. Under normal use, battery life is expected to provide approximately 5,000 temperature measurements for Model 692, and 6,000 temperature measurements for Model 690. This number is based on a 22.2 ºC (72.0 °F) ambient temperature, with the security features turned off. Colder ambient temperatures, excessive security alarms, use of non-alkaline batteries, and other usage patterns can reduce battery life. Instruments are shipped with fresh batteries, but we cannot guarantee full life from the first set of batteries due to potential long storage times between shipping and actual use. Battery life is also reduced by storage at elevated temperatures.

The battery holder is interlocked to prevent reverse polarity. This is an important aspect of safe operation of the unit.

5.1.4 Low Battery Detection

The Model 690 and 692 Thermometers include a low battery detector circuit, which shuts the device off when the battery degrades below 3 volts. This ensures that erroneous temperature readings are not given due to a low battery.

5.1.5 Temperature Measurement and Display

The thermometer probes incorporate negative temperature coefficient thermistors. When the temperature of the probe is increased, its electrical resistance decreases.

Model 690 and 692 Thermometers use 20K thermistors, providing a resistance of approximately 20 KΩ at room temperature. At 37°C (patient temperatures) they are near 12 KΩ. The change in resistance is nonlinear with temperature and an equation describing this curve is programmed into the thermometer.

Appendix A Specifications

Ambient Operating Temperature Range	50.0 °F to 104.0 °F (10.0 °C to 40.0°C)
Operating Altitude	-557 ft. to +16,000 ft / -170m to +4877m
Patient Temperature Range	80.0 °F to 110.0 °F (26.7 °C to 43.3 °C)
Temperature Predict Time*	Oral: Approximately 4–6 secs. Adult axillary (18 years and older): Approximately 12–15 secs. Pediatric axillary (17 years and younger): Approximately 10–13 secs. Rectal: Approximately 10–13 secs.
Transport/Storage Temperature	-13°F to +131°F (-25°C to +55°C)
Calibration Accuracy	+/- 0.2 °F (0.1 °C) (Monitor Mode)
Humidity	15% to 95% non-condensing
Dimensions	8.46” x 3.18” x 2.43” (215mm x 81mm x 62mm)
Weight	12.6 ounces/357 grams
Power	(3) 1.5Vdc AA batteries
Equipment Classification	Class 2 Device, Continuous Operation Not AP or APG equipment
IPXØ	Not protected against the ingress of water.

* Predict time depends on probe placement and patient condition. Predict times do not include tissue contact-detection time or time needed to place the probe into the measurement site.

Appendix B Limited Warranty

THREE-YEAR LIMITED WARRANTY ON MODEL 692 AND TWO-YEAR LIMITED WARRANTY ON MODEL 690 INSTRUMENTS

Instrumentation purchased new from Welch Allyn, Inc. (Welch Allyn) is warranted to be free from original defects in material and workmanship under normal use and service for a period of three years for Model 692 and a period of two years for Model 690 from the date of first shipment from Welch Allyn. This warranty shall be fulfilled by Welch Allyn or its authorized representative repairing or replacing at Welch Allyn's discretion, any such defect, free of charge for parts and labor.

Welch Allyn must be notified via telephone of any defective product and the item must be immediately returned, with an RMA number provided by Welch Allyn, securely packaged and postage prepaid to Welch Allyn. Loss or damage in shipment shall be at the purchaser's risk.

Welch Allyn will not be responsible for loss associated with the use of any Welch Allyn product that (1) has had the serial number defaced, (2) has been repaired by anyone other than an authorized Welch Allyn Service Representative, (3) has been altered, (4) has been used in a manner other than in accordance with the instructions, or (5) has been abused or exposed to extreme environmental conditions.

ONE-YEAR LIMITED WARRANTY ON PROBES AND PROBE COVERS

Welch Allyn warrants probes and probe covers to meet Welch Allyn's specifications for the Product at the time of purchase and to be free from original defects in material and workmanship under normal use and service for a period equal to one-year from the date of first shipment of such Product to the customer by or on behalf of Distributor. Probe covers are intended for single use only.

NINETY DAY LIMITED WARRANTY ON REMOVABLE PROBE WELLS

Removable probe wells (blue oral and red rectal) are warranted to be free from original defects in material and workmanship under normal use and service for a period of ninety days from the date of first shipment from Welch Allyn.

THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ANY IMPLIED WARRANTY OR MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, OR OTHER WARRANTY OF QUALITY, WHETHER EXPRESSED OR IMPLIED. WELCH ALLYN WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM THE SALE, USE, OR IMPROPER FUNCTIONING OF THE INSTRUMENTATION REGARDLESS OF THE CAUSE. THE DAMAGES FOR WHICH WELCH ALLYN WILL BE RESPONSIBLE INCLUDE, BUT ARE NOT LIMITED TO, LOSS OF REVENUE OR PROFIT, DOWNTIME COSTS, AND LOSS OF USE OF THE INSTRUMENTATION.

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